



**GEO-
INSTITUTE**

INNOVATIONS, DEVELOPMENTS, ENHANCEMENTS, AND ADVANCEMENTS (IDEA)

**Protocol for Technical Evaluation of
Earth Retention System**

WWW.GEOINSTITUTE.ORG/SPECIAL-PROJECTS/IDEA

INNOVATIONS, DEVELOPMENTS, ENHANCEMENTS, AND ADVANCEMENTS (IDEA)



**GEO-
INSTITUTE**

“Advancing the geo-professional community”

REVISION HISTORY				
Revision Date	Description	Sections Affected	Revised By	Approved By
January 2021	First Issue from the Geo Institute	All	NA	IDEA Evaluation Review Panel
March 2021	Clarify roles and responsibilities of Review Team	2.5.2	Geo-Institute	IDEA Evaluation Review Panel
December 2025	Revise update evaluation section	2.4.3	Geo-Institute	IDEA Evaluation Review Panel

SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
AREA				
in ²	square inches	645.2	square millimeters	mm ²
ft ²	square feet	0.093	square meters	m ²
yd ²	square yard	0.836	square meters	m ²
ac	acres	0.405	hectares	ha
mi ²	square miles	2.59	square kilometers	km ²
VOLUME				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft ³	cubic feet	0.028	cubic meters	m ³
yd ³	cubic yards	0.765	cubic meters	m ³
NOTE: volumes greater than 1000 L shall be shown in m ³				
MASS				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
TEMPERATURE (exact degrees)				
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
ILLUMINATION				
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m ²	cd/m ²
FORCE and PRESSURE or STRESS				
lbf	poundforce	4.45	newtons	N
lbf/in ²	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
AREA				
mm ²	square millimeters	0.0016	square inches	in ²
m ²	square meters	10.764	square feet	ft ²
m ²	square meters	1.195	square yards	yd ²
ha	hectares	2.47	acres	ac
km ²	square kilometers	0.386	square miles	mi ²
VOLUME				
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m ³	cubic meters	35.314	cubic feet	ft ³
m ³	cubic meters	1.307	cubic yards	yd ³
MASS				
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
TEMPERATURE (exact degrees)				
°C	Celsius	1.8C+32	Fahrenheit	°F
ILLUMINATION				
lx	lux	0.0929	foot-candles	fc
cd/m ²	candela/m ²	0.2919	foot-Lamberts	fl
FORCE and PRESSURE or STRESS				
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in ²

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380.
(Revised March 2003)

TABLE OF CONTENTS

- 1.0 INTRODUCTION1**
 - 1.1 History of the HITEC Program.....1
 - 1.2 Objectives of the Highway IDEA Program1
- 2.0 GUIDANCE FOR THE TECHNICAL EVALUATION OF EARTH RETENTION SYSTEMS.....3**
 - 2.1 Focus of the Protocol3
 - 2.2 Definition of a “System”.....3
 - 2.2.1 Components5
 - 2.2.2 Design.....5
 - 2.2.3 Construction.....6
 - 2.2.4 Quality Control.....6
 - 2.3 Types of Technical Evaluations.....7
 - 2.3.1 Initial Technical Evaluation.....7
 - 2.3.1.1 The Initial Technical Evaluation Process.....7
 - 2.3.1.2 Initial Technical Evaluation Schedule.....10
 - 2.3.2 Update Technical Evaluation.....11
 - 2.3.3 System Review11
 - 2.3.4 Update Technical Evaluation.....11
 - 2.4 Evaluation Cost Structure12
 - 2.4.1 Initial Technical Evaluation Cost Structure.....12
 - 2.5 Evaluation Review Panel and Review Team13
 - 2.5.1 Evaluation Review Panel.....13
 - 2.5.2 Review Team.....13
 - 2.6 References for Technical Evaluations14
 - 2.7 Technical Evaluation Application Organization.....15
 - 2.7.1 Components15
 - 2.7.2 Design Methodology16
 - 2.7.3 Construction.....16
 - 2.7.4 Quality Control Measures.....17
 - 2.7.5 ERS Performance History17
 - 2.8 Submittal Checklists17
- 3.0 GUIDANCE FOR USE OF TECHNICAL EVALUATIONS BY TRANSPORTATION AGENCIES.....18**

3.1	Consideration of the Elements of an ERS.....	18
3.2	Guidelines for Approval of an ERS.....	19
3.2.1	Performance Conditions	20
3.2.1.1	ERS Geometry.....	20
3.2.1.2	ERS Loads.....	20
3.2.1.3	Environmental Factors	21
3.2.1.4	Geotechnical Factors	21
3.2.1.5	Constructability Factors	21
3.2.1.6	Other Factors	22
3.3	Specifications for ERS evaluations.....	22
4.0	GUIDANCE FOR ADMINISTRATION AND MAINTENANCE OF FINAL REPORTS OF TECHNICAL EVALUATIONS	23
4.1	Administration	23
4.1.1	Report Coordination	23
4.1.2	Report Distribution.....	23
4.1.3	Report Archiving.....	23
4.2	Report Maintenance	24
4.2.1	Statement of Technical Evaluation Report Currency	24
5.0	REFERENCES	25

APPENDIX A—Highway Innovation Developments, Enhancements and Advancements –
Technical Evaluation Process

APPENDIX B—Highway Innovation Developments, Enhancements and Advancements –
Checklists for Different Earth Retaining System Types

SEE IDEA WEBSITE FOR LATEST CHECKLISTS:

<https://www.geoinstitute.org/special-projects/idea>

**APPENDIX C – LEGACY FEDERAL HIGHWAY ADMINISTRATION PUBLICATION
COVER AND INFORMATION**

GLOSSARY OF TERMS

Agreement for Technical Evaluation: The written agreement between the Applicant and the Review Team Entity to conduct an evaluation.

Applicant: A manufacturer or holder of a patented earth retaining system that wishes to undertake a technical evaluation under the IDEA program.

Final Submittal Review Phase: The last phase of the technical evaluation process in the IDEA program.

Initial Submittal Review Phase: The first phase of the technical evaluation process in the IDEA program.

Initial Technical Evaluation: The first technical evaluation performed for a given earth retaining system performed in either the HITEC or IDEA programs.

Manufacturer: The company or entity that fabricates ERS components and/or systems

Pre-Submittal Review Phase: The initial step of preparing an application and developing an Agreement for Technical Evaluation.

Report of Initial Technical Evaluation: The final report that presents the findings of the Initial Technical Review.

Submittal Check Phase: A completeness review of the original submittal for technical evaluation.

System Review: A periodic review of an ERS that has previously received a complete Technical Evaluation.

Update Technical Evaluation: A Technical Evaluation performed on an ERS with a prior complete Technical Evaluation that has had a significant change or innovation since the initial Technical Evaluation was performed.

LIST OF ABBREVIATIONS AND SYMBOLS

AASHTO	American Association of State Highway and Transportation Officials
ASCE	American Society of Civil Engineers
ASD	Allowable stress design
CERF	Civil Engineering Research Foundation
ERS	Earth retaining system
FHWA	Federal Highway Administration
HITEC	Highway Innovative Technology Evaluation Center
IDEA	Highway Innovations, Developments, Enhancements and Advancements
LRFD	Load and resistance factor design
MSE	Mechanically stabilized earth
NTPEP	National Transportation Product Evaluation Program
TRB	Transportation Research Board

1.0 INTRODUCTION

1.1 History of the HITEC Program

The Highway Innovative Technology Evaluation Center (HITEC) was established in 1994 as a collaborative effort by the Federal Highway Administration (FHWA), American Association of State Highway and Transportation Officials (AASHTO) and the Transportation Research Board (TRB) to accelerate the process by which technological advances are introduced for use in highway infrastructure (HITEC, 1998). The HITEC Program has been administered through the Civil Engineering Research Foundation (CERF) of The American Society of Civil Engineers (ASCE). The structure of HITEC was designed to facilitate comprehensive consensus-based nationally accepted performance evaluations of new or innovative technologies for the highway community.

Until 1994, many of the state transportation agencies had no formal process to evaluate earth retention systems and often lacked the technical resources that such evaluations require. Some agencies had protocols for technical evaluations, but the protocols were far from uniform. Consequently, the transfer of innovative earth retention technology from the private to the public sector was decidedly impeded.

The HITEC earth retaining system (ERS) program was created to evaluate the performance of proprietary ERS technologies. It was designed based on information and recommendations from federal, state and local highway officials, as well as the manufacturers of earth retention systems. The goal of the program was to provide transportation agencies ERS evaluations, thereby increasing the efficiency of agency approval processes.

Over a period of about 20 years, 18 complete earth retention systems were evaluated and each documented with a final report. These evaluations compelled critical thinking by both transportation officials and manufacturers on challenging earth retention issues. Now, many of those issues have been resolved and MSE retention has become a commonly accepted component of transportation infrastructure. To advance innovation in ERSs and help disseminate new technologies into practice with public transportation agencies FHWA has prepared this protocol for Innovations, Developments, Enhancements, Advancements (IDEA) for ERSs.

1.2 Objectives of the Highway IDEA Program

The IDEA program has three objectives:

- Update and improve the existing HITEC Technical Evaluation Protocol for new and modified earth retention systems and ERS components to provide a timely, transparent and cost-effective evaluation process.

- Develop guidance for use of Technical Evaluations by project owners and/or transportation agencies.
- Develop guidance for administration and maintenance of Technical Evaluations, including periodic system reviews.

The emphasis on innovation is not limited to MSE systems. It is anticipated that ERS innovations will include new technologies and modifications of existing ones. Areas where innovations are expected to develop include: corrosion/durability; spacing of reinforcement; connections; facing details; extensibility; and drainage. These are some of the technically challenging issues that are excellent candidates for innovation that will ultimately benefit the state Departments of Transportation, their highway projects, and the public as well as future development of ERSs.

2.0 GUIDANCE FOR THE TECHNICAL EVALUATION OF EARTH RETENTION SYSTEMS

2.1 Focus of the Protocol

Guidance for the technical evaluation of earth retention systems is provided in the form of a protocol. The focus of the IDEA protocol differs from that of the HITEC protocol in that HITEC was used specifically to evaluate the relatively new technology of mechanically stabilized earth (MSE) walls. Over time, the HITEC process helped to identify issues that are indeed critical for the proper performance of MSE structures, as well as some that are less relevant than previously thought. The IDEA program recognizes that MSE is a mature technology and the protocol has been updated to reflect the state of knowledge and state of practice.

The IDEA protocol addresses many MSE system details that are included in the HITEC protocol. However, it is assumed that applicants for an ERS evaluation are experienced with respect to the requirements of the standard of practice and should have little difficulty completing most of the items in the IDEA protocol checklist (see Section 2.7). The emphasis of the IDEA program is on *innovation*. The protocol is designed to check ERS compliance with the standard of practice, but also to evaluate aspects of the system that advance the state of the practice.

2.2 Definition of a “System”

To define a “system” it is helpful to first consider the types of earth retention systems that are presently in use. These systems are listed below and outlined in Figure 2-1 (Tanyu et al., 2001):

- Rigid gravity and semi-gravity systems.
- Prefabricated modular gravity systems.
- MSE systems.
- Non-gravity cantilevered and anchored systems (i.e. sheet pile, soldier pile and lagging, slurry, tangent and secant pile, master/king pile).
- In-situ reinforced systems (e.g. soil nail, micro-pile).
- Chemically stabilized earth systems (e.g. jet grout, soil mix).

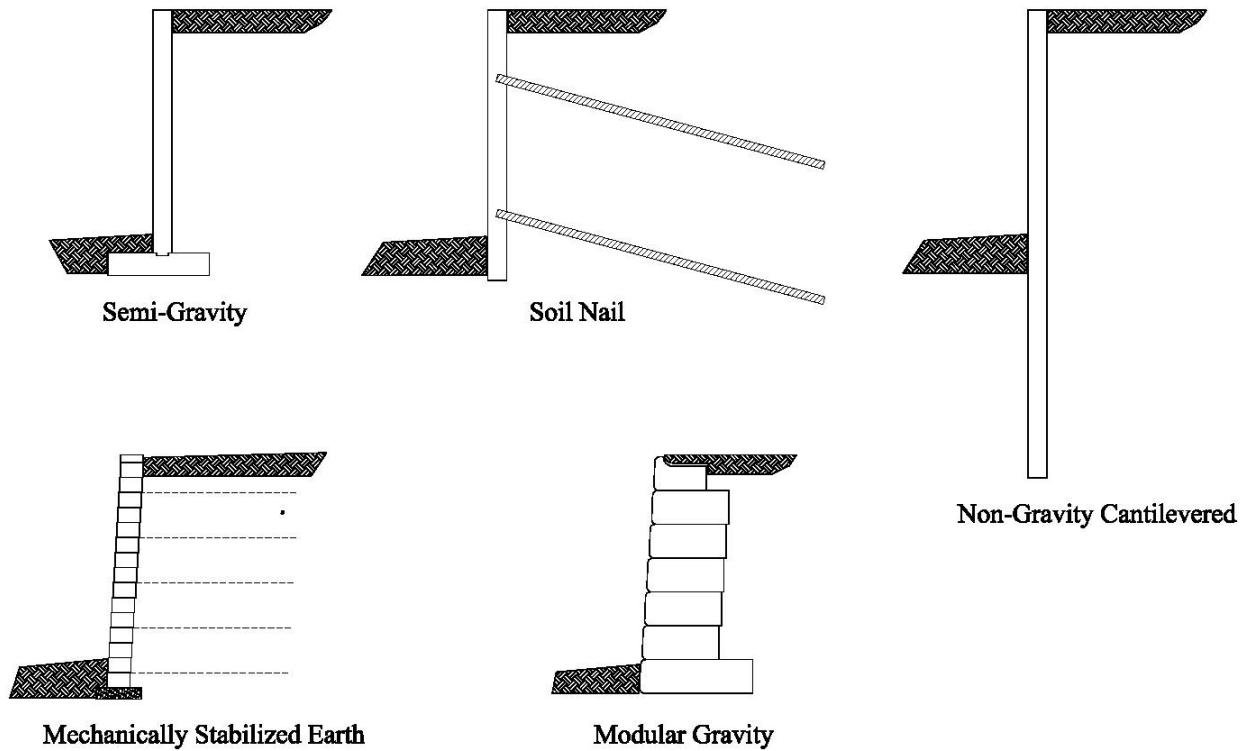


Figure 2-1: Types of Earth Retaining Systems

These systems rely on the fabrication of application-specific components using diverse materials. The properties of components are linked together by a design methodology that is based on theories of earth pressure and soil-structure interaction to produce an earth retention model. That model is transformed into reality through techniques of construction that are specific to the design theories, system components and field conditions. At each step of fabrication, design and construction, specific measures are required to control overall quality.

Accordingly, the IDEA protocol defines an earth retaining system as a unit that comprises the following elements:

- Specific components and the materials used for their manufacture.
- Design methodologies.
- Construction procedures.
- Quality control measures.

The relationship of each of these to an earth retaining system is discussed in this section.

2.2.1 Components

Earth retaining system (ERS) components are manufactured for different purposes using different materials and different techniques. Components can be specific to a particular system and can be characterized by the following functions:

- Components can be temporary or permanent.
- Components can function as facing, to anchor facing, support facing and/or align facing.
- Components can reinforce soil, restrain soil and/or drain soil.
- Components can be fabricated from steel, concrete, cement grout, geosynthetics, polymeric composites, soil, rock, recycled construction materials or a combination of these materials.
- Components have evolved from those made in traditional steel and concrete plants and that resisted soil pressure by relative brute-force methods. Now components are also made using injection molds, lasers, looms and extruders to provide tensile strength to the soil structure and resist aggressive electrochemical soil processes.

2.2.2 Design

The selection of a design methodology for an ERS is based on many factors including the structure type, system stiffness, the material that is retained, site conditions and deflection limits (Tanyu et al. 2001). These factors dictate the earth pressures used for design of the ERS, as noted in the following examples:

- Traditional Rankine or Coulomb earth pressure models remain appropriate for gravity and semi-gravity systems; however, modifications of such models may be advantageous and justifiable for modular gravity systems or systems with different types of reinforcement¹.
- A Coulomb earth pressure model may be appropriate for the soil retained by a cantilevered pile system but P-Y curves or numerical analyses may be needed to adequately estimate total pile deflection.
- The earth pressure diagram that is used for a system that is restrained by tiebacks depends on the strength and physical properties of the soil that is retained and whether a single level or multiple levels of anchors are used. Also, the selected earth pressure acting on the system must consider each stage of construction.

¹ FHWA guidance (FHWA NHI-10-024) acknowledges that the reinforcement stiffness can influence the ability of the wall to mobilize fully active conditions; and further, the actual earth pressure coefficient can vary with depth behind the wall.

- MSE structures are typically designed using conventional earth pressure theory. The resulting models can be modified to better account for different ERS component stiffnesses. Limit equilibrium models are constructed using either allowable stress design (ASD) or load and resistance factor design (LRFD).
- Numerical methods are being used with increasing frequency to better account for stress-strain relationships between components and loads.
- The design methodology must consider both internal stresses on system components and external (i.e. global) stability of the entire ERS.

2.2.3 Construction

Construction procedures that are indicated for a specific ERS depend on a variety of factors.

- Perhaps the most fundamental factor that determines construction procedures is whether the ERS will be cut or fill. A cut wall may often dictate the use of top-down construction techniques, thereby limiting construction options to those associated with non-gravity cantilevered, anchored, soil nail or chemically stabilized systems. Deflection limits or structure height may require the use of anchored wall systems with tiebacks. Each of these top-down systems has a unique set of construction requirements.
- Fill ERS construction proceeds from the bottom up. The many systems available for this method of earth retention have similar procedures for construction, but also important distinctions. For example, modular block facing systems are typically dry stacked, but some require the installation of components to align blocks and secure them to earth reinforcement. Similarly, panel systems for ERSs are typically attached to earth reinforcement using an array of techniques, many of which are described by detailed installation specifications. Panels also typically require bracing to assure stability and alignment.

2.2.4 Quality Control

An ERS comes with a set of quality control measures that it often shares in common with other systems as well as particular measures that are unique. Such measures should be taken during system design, as well as during component fabrication and ERS construction.

- Examples of two common quality control requirements during fabrication of concrete modular blocks are 1) periodic testing of compressive strength and 2) dimensional tolerances. However, some modular block systems require the insertion of alignment, shear or reinforcement connection devices that are fabricated from different materials and that entail a unique set of measures to assure the devices' strength and dimensional integrity.
- Quality control measures that should be common between the designs of different earth retention systems include: 1) determination of soil shear strength parameters; 2) Earth

retaining structure section geometries; 3) surcharge loads; and 4) factors of safety against overall stability failure. However, other design parameters are unique to individual systems. Examples of these include: 1) stresses in MSE reinforcement elements; 2) stresses in anchor tendons; 3) stresses at the connection between the system facing and earth reinforcement or anchor tendons; 4) stresses in steel reinforcement of precast concrete facing panels; and 5) bending stresses in cantilevered or anchored non-gravity system elements.

- There are numerous ways to connect earth reinforcement to precast concrete facing panels. However, the details of the connection are usually unique to a given system. Similarly, the requirements for inspection of a connection are thus usually system-dependent.

As illustrated in the discussion above, the four elements addressed in the IDEA protocols (components, design methodology, construction procedures, and quality control measures) apply to all systems, but the specific details and requirements of each will vary widely for the different ERSs. Innovative improvement to any of these elements is a focus of the IDEA program.

2.3 Types of Technical Evaluations

There are two types of Technical Evaluations to assess earth retaining systems:

- An Initial Technical Evaluation.
- An Update Technical Evaluation.

2.3.1 Initial Technical Evaluation

An Initial Technical Evaluation is performed to assess an ERS that has not been previously reviewed under the IDEA program's protocol, the HITEC program, or other similar process. Given the objective of innovation in the IDEA program, ERSs that have had previously obtained a Technical Evaluation through the HITEC Program do not need to undergo an Initial Technical Evaluation under the IDEA program, but an Update Technical Evaluation may be appropriate.

2.3.1.1 The Initial Technical Evaluation Process

An Initial Technical Evaluation consists of a four-phase process as summarized in tabular form in Appendix A and described below. The four phases include:

- Pre-Submittal Review Phase.
- Submittal Check Phase.
- Initial Submittal Review Phase.
- Final Submittal Review Phase.

Pre-Submittal Review Phase

The Pre-Submittal Review Phase is initiated when the Applicant provides its request for a Technical Evaluation (see Appendix B) to the agency or entity that has been assigned the responsibility for the IDEA program administration (to be determined). The request is accompanied by a brief description of the Applicant's ERS and designation of the checklist the Applicant believes to be appropriate. Checklists for various types of ERSs are presented in Appendix C.

The IDEA program Administrator forwards the application to the Lead Review Consultant (see Section 2,5) who reviews the request and approves for technical evaluation. Upon authorization for an evaluation, the Lead Review Consultant informs the Administrator the plans to begin the evaluation. At this time, the Lead Review Consultant may provide comments directed to the Applicant for overall suggestion and/or missing elements.

An important determination at this stage is whether a custom checklist should be developed by the Review Team. If a custom checklist is needed, then the time and cost to prepare it must be determined and included in the schedule and cost for the Submittal Check Phase. If the proposed schedule and cost are acceptable to the Applicant, then an Agreement for Technical Evaluation is executed.

Submittal Check Phase

Following execution of the Agreement for Technical Evaluation, the Applicant prepares its submittal. The importance of adherence to the submittal format and completeness should be emphasized to the Applicant, and it should be cautioned that formatting errors will result in a delay of this phase of the review.

The Applicant should also be advised that if the proposed ERS contains an innovation or change to a previously-evaluated system, then it is the Applicant's responsibility to thoroughly document the innovation in terms of complete descriptions, test data, and design methodology. Essentially, the Applicant must "prove" the innovation using sound engineering, particularly if the innovation does not conform to current reference standards. The Applicant should also address the patent status of the innovation and provide documentation of technology ownership.

Experience demonstrates that a technically sophisticated Applicant can have reasonable questions regarding the submittal requirements. If the Applicant has no prior experience with HITEC or a comparable transportation agency review process, or if a custom checklist must be used, then the Applicant's uncertainty will be increased. If the Applicant need for clarification is not satisfied, then the submittal will possibly contain errors and omissions. Resolution of these can take several iterations of reviewer comments and applicant responses. Therefore, the Applicant and the Review Team should use clear and direct communication to avoid multiple submittals and reviews. Failure to do so may create frustration, increase costs and delay review completion.

To encourage clear communication, this protocol permits the Applicant to request a meeting with the Review Consultant and the Review Team before the Applicant completes its submittal. During the meeting the Applicant should request any clarifications needed to help comply with IDEA program requirements.

Upon receipt of the submittal, the Review Consultant evaluates it for completeness and format. The Consultant's Report of Submittal Check presents the findings of this phase of review. If additional information or changes are required, the Consultant will summarize them in the report using bulleted items that specifically describe how and which sections of the submittal should be changed to satisfy format requirements or clarify additional information that is needed. Then the submittal and a draft version of the report are provided to the Review Team. Upon approval of the report by the Review Team, a final version is sent to the Applicant.

If the report indicates the submittal is deficient, the Applicant may request a second meeting with the Consultant and Review Team member to discuss and clarify how the deficiencies can be resolved.

The Applicant might at this point elect to withdraw from the review process, particularly if it finds that it is unable to provide a sufficiently complete submittal. In the event of a withdrawal, the Review Administrator will document the withdrawal by the Applicant. However, if the Applicant provides a complete and properly formatted submittal, the Initial Submittal Review Phase may begin.

Submittal Review Phase

The Consultant now evaluates the technical content of the submittal for conformance to the applicable references, as discussed in Section 2.5. For submittals that describe an innovation, the adequacy of the submittal with respect to "proof" of the innovation are a focus of the Consultant's effort. The Consultant's Preliminary Report of Technical Evaluation presents findings factually and succinctly. A draft version of this report and the submittal are then provided to the Evaluation Review Team. Upon approval of the report by the Review Team, a final version is sent to the Applicant.

If the report indicates deficiencies with the ERS, the Applicant may request a meeting with the Review Consultant and a Panel member to discuss and clarify methods by which the deficiencies can be resolved.

The Applicant might determine that its interests are not best served by a Final Report of Review and elect to withdraw before starting the final phase. However, if the Applicant provides a response to the Preliminary Report of Review, then the Final Submittal Review Phase may begin.

Final Submittal Review Phase

The Applicant's response is used to complete the review. The Consultant's Report of Initial Technical Evaluation includes a discussion of the following:

- ERS Type.
- Components.
- Design Methodology.
- Construction.
- Quality Control.
- Performance History.

The innovation will be the emphasis of the report, and the report will state whether the technical evaluation is an initial or an update. In the case of an initial evaluation, the report will note that an update evaluation may be required if any element of the ERS is significantly changed.

2.3.1.2 Initial Technical Evaluation Schedule

The time that is required to perform each phase of the review will depend on a number of factors, some of which are beyond the control of the Review Consultant and the Review Team. In particular, the ERS type and complexity of the potential innovations of the ERS may significantly affect the time that is required for its review. However, the time for this work can be estimated. The turnaround time that the Applicant requires to respond to or prepare revisions in response to the panel evaluations described in the previous section cannot be estimated.

The Applicant is given an estimate for the time the Consultant and Review Team require to perform their work during the Submittal Check Phase after the Consultant has had the opportunity to review the submittal and assess its complexity. The Applicant is reminded that the total time required to complete the Submittal Check Phase depends on the Applicant's timely response to the Report of Submittal Check.

A meaningful estimate of the time required for the Consultant and Panel to perform their work for the initial and final review phases probably cannot be provided to the Applicant until the Report of Submittal Check is completed. However, if the ERS comprises an MSE or gravity system consistent with one of the existing checklists, the time required for the Consultant's and Panel's work would typically be as follows:

- Pre-Submittal Review Phase—2 weeks
- Submittal Check Phase—2 weeks
- Initial Submittal Review Phase—3 weeks
- Final Submittal Review Phase—5 weeks

The schedule may be significantly affected by a need to use a custom checklist or if the proposed ERS includes an innovation requiring significant documentation and review.

2.3.2 Update Technical Evaluation

The Initial Technical Evaluation is updated every 5 years or when a significant modification to the system has been made. Update Evaluations are important to assure users that the information about an ERS is current and remains accurate. The decision to perform an Update Technical Evaluation is based on the results of a System Review, as described below.

2.3.3 System Review

A System Review is performed to determine if a “significant” change has been made by the Applicant to an ERS element or if a change has been made to one of the relevant references defined in Section 2.5. A System Review is indicated by one of the following:

- Notification from the Applicant of a change in an element of the ERS.
- Significant change in one of the references for review (i.e. revision of an AASHTO specification or FHWA guideline).
- Finding by a state transportation agency that a system is significantly changed compared to a prior system evaluation. This may occur for example, if an agency notices a difference in the system’s description in a Report of Initial Technical Evaluation compared to a design submittal for the ERS for a specific project.
- Passage of a period of 5 years following the publication of the Report of Initial Technical Evaluation.

2.3.4 Update Technical Evaluation

The scope of an Update Technical Evaluation depends on what triggered it. For example, if a system component has changed, the review would be primarily focused on the changed/modified ERS element.

If the evaluation is triggered by the passing of a period of 5 years since the publication of the Report of Initial Technical Evaluation, then the scope will be broader and consider any changes to the following evaluation checklist items:

- Modification of the system components.
- Changes in the AASHTO/FHWA design methodology, if different from the design method used in the original system evaluation.
- Changes to the construction procedures.
- Update on performance history over the five years.
- Inclusion of updated reinforcement product data from Product Evaluation and Audit Solutions and/or related interaction data.

- Published IDEA protocol modifications.

IDEA will communicate with the ERS vendor six months before the renewal of their technical evaluation report. The ERS vendor shall submit the IDEA renewal form application and any system changes listed above at least ninety days prior to the renewal of the evaluation report. The renewal form provides the declaration of system modifications regarding the ERS checklist items listed above. The form offers the option to indicate that there are no changes from the original submittal of ERS.

Vendor attestation for no ERS changes does not require a reevaluation. Otherwise, declared changes to ERS elements will require the wall supplier to submit a reevaluation checklist and supporting documents. IDEA will designate a Review Consultant to oversee and approve the reevaluation report. At the Review Consultant's discretion, a second reviewer may be invited to assist with the reevaluation.

The evaluation report will not be available for public download until the reevaluation is complete. At that time, a new report with a new five-year term will be available on the Geo-Institute IDEA web page. All past IDEA reports will be archived on the IDEA website.

2.4 Evaluation Cost Structure

The Applicant will finance the cost of the ERS evaluations performed by the Review Panel, the Review Team and the Team's Consultant. The cost for the Initial Technical Evaluation and the Update Technical Evaluation are different. As described below, it is structured to provide the Applicant with flexibility in financing the evaluation process. Partial payment for each evaluation stage is scheduled at each review phase and is made before work for the respective phase begins. Therefore, separate payments are to be made for the cost items described below.

2.4.1 Initial Technical Evaluation Cost Structure

- Cost item 1—Pre-Submittal Review Phase (i.e. an application fee).
- Cost item 2—Submittal Check Phase.
- Cost item 3—Initial Submittal Review Phase.
- Cost Item 4—Final Submittal Review Phase.

The rationale for this structure is to reduce the financial risk to the applicant by providing a structure that allows the applicant to withdraw its evaluation request at the end of any phase. Distribution of the total cost across the four review phases is beneficial if the Applicant decides during the Submittal Check Phase or the Initial Submittal Review Phase that it is not in the Applicant's interest to continue with a Final Submittal Review Report.

The System Review and Update Technical Evaluations are intended to be structured as an update of Cost Item 4—The Final Submittal Review Report, described above. The extent of the System or Update Technical Review and its associated cost also depend on the specific scope of the

review. For the purpose of these types of evaluation, it is envisioned that the System Review cost will be less than the Update Technical Review that it may trigger. This is because the least expensive System Review would be an affirmation that no significant changes are needed to an ERS, while the Update Technical Review does not involve additional technical evaluation. Similar to the Initial Technical Evaluation, the estimated cost for each of these review phases is determined prior to the review such that the Applicant can understand the financial commitment with each review phase.

2.5 Evaluation Review Panel and Review Team

2.5.1 Evaluation Review Panel

The evaluations for the IDEA Program are performed under the authority of the Evaluation Review Panel. The Evaluation Review Panel comprises leaders in the field of ERSs and are drawn from public agencies, academia, ERS manufacturers, and practitioners familiar with ERSs. The Evaluation Review Panel has approximately 20 to 30 members and serve on a volunteer basis with interest in the overall development and advancement of ERS technology, and operate under the auspices of the program Administrator (TBD). The role of the Evaluation Review Panel is to provide governance for the administration of the IDEA program rather than perform specific evaluations. The Panel is responsible for developing a Charter to specify the details of the evaluation process.

2.5.2 Review Team

Members of the Review Team are drawn from the Evaluation Review Panel for the purpose of overseeing the process of technical evaluations and to review the findings and recommendations of its Review Consultant.

Personnel who are considered for service on the Review Team should possess general expertise in earth retention as it relates to design, specifications, research, testing and manufacturing. However, if a candidate for the Review Team has a professional or commercial conflict of interest with the proposed evaluation, may be replaced at the discretion of the Review Panel. The Lead Review Consultant should have expertise with the specific type of system that is under review as well as with the relevant design standards (see Section 2.3). Given that there are technical evaluations of ERSs of different types, the composition of the Review Team may be different for separate evaluations depending on the specific expertise needed for a particular system type. Members of the Review Team including the Lead Review Consultant, are selected from members of the Review Panel.

The Review Team is charged with assessing the components, design methodology, construction, quality control and performance history of the ERS. The assessment is not considered as a system approval report. Instead, the Review Team intends to describe within the IDEA report:

- Review Summary
- System Components
- Innovations, if any, in the system
- Changes to standard practice include innovations in ERS.
- System Properties.

The Review Team is comprised of four professionals as described above. The Review Team roles are Lead Review Consultant (LRC) and three members of the Review Team. The LRC has overall responsibility for the system evaluation and to finalize the review report. The three review team members provide review of the Preliminary Report of Technical Evaluation. Detail activities of the technical evaluation is shown in Appendix A. Prior to starting the evaluation process as described in Appendix A, the LRC and IDEA Administrator should meet with the Applicant to describe the process and solicit Applicant questions.

The LRC has overall responsibility for the evaluation and the actions associated with the Review Team. The LRC relies on the review team to provide a review of the draft evaluation, and the LRC may also consult with team members on particular system issues. The LRC is given full authority on the adjudication of review team comments and will document the review team comments' actions. Individual team comments should be organized by the evaluation section, particular comment, and comment action. Using a spreadsheet is recommended to manage comments in this manner.

2.6 References for Technical Evaluations

Technical Evaluations are based upon information that is submitted by the party that has applied for a review of its ERS (i.e. the Applicant) and existing guidelines and standards that apply to the ERS type. For example, if the Applicant's ERS classifies as an MSE retention structure then applicable references may include:

- The Applicant's technical submittal for its system.
- *American Association of State Highway and Transportation Officials. AASHTO LRFD Bridge Design Specifications, 10th ed., Washington, DC, 2024 (with 2025 Errata).*
- Federal Highway Administration. Design and Construction of Mechanically Stabilized Earth (MSE) Walls, Geotechnical Engineering Circular No. 11, FHWA-HIF-24-002, Washington, DC, 2023.
- V. Elias, K. Fishman, B.R. Christopher, and R.R. Berg, Corrosion/Degradation of Soil Reinforcements for Mechanically Stabilized Earth Walls and Reinforced Soil Slopes, FHWA-NHI-09-087, Federal Highway Administration, Washington, DC, 2009.
- Current ASTM Standards

Other types of ERSs may indicate the use of other references. For example, if the system involves the use of ground anchors, then *Geotechnical Engineering Circular No. 7 Ground Anchors and Anchored Systems* (Sabatini et al., 1999) is likely relevant. If the system involves the use of soil nails, then *Geotechnical Engineering Circular No. 7 Soil Nail Wall-Reference Manual* (Lazarte et al., 2015) is likely relevant. Some local agencies may have established guidance or technical procedures that may also be appropriate references. Local conditions are also be important considerations. For example methods for addressing seismicity are treated differently in different references and it is important to consider the best way to incorporate this in a submittal. Allowable Stress Design methods may also provide an appropriate design approach. In addition, ERSs that have been developed internationally and have been developed using other technical standards or references (e.g. Eurocode) may refer to these standards or references; however, FHWA and AASHTO references will typically be primary references, as appropriate.

The references serve as a baseline to assess a system’s conformance with current engineering practices. In fact, an innovative system likely does not conform to current practices and would not necessarily be judged deficient. Rather, the nonconformance may be an innovation and an opportunity to advance the state of practice, provided that sufficient information is included in the application as a basis for completion of the technical evaluation. It is important to demonstrate that the design method for an innovation is consistent with an applicable guidance document, or that the innovation is an appropriate adjustment to an established design methodology.

2.7 Technical Evaluation Application Organization

The Technical Evaluation is designed to assess all types of earth retaining systems. It is anticipated that in the near term, most Applicants will request an evaluation of MSE and modular gravity systems. For this reason, the protocol and the current checklists are oriented toward these structures. See Appendix A for current evaluation checklists.

Given that innovation is a focus of the IDEA program, it is hoped that requests for reviews of other types of ERSs will be received and that modifications to the protocol and/or checklists will be required. In these cases the protocol are be modified as necessary on a case-by-case basis in coordination with the Applicant. However, all Technical Evaluations consider the ERS elements and performance history as described below.

2.7.1 Components

Drawings, specifications and test results for components are required. For example, consider an ERS that includes a reinforced precast concrete facing panel with embedded steel connectors that attach to earth reinforcement. The panel, reinforcement and connectors should be drawn in elevation, plan and section views with dimensions and descriptions. Panel specifications should

address its dimensional tolerances, constitutive materials, and compressive strength. Test results should document the pullout capacity of the embedment from the panel. Similar drawings and technical specifications are needed for the many essential components that an ERS may require for proper performance.

In the case of geosynthetic earth reinforcement, drawings that illustrate its location in a system are needed as are the material's property specifications. However, if the geosynthetic has been assessed by the National Transportation Product Evaluation Program (NTPEP), the NTPEP report may be submitted in lieu of some geosynthetic test data. Additional technical information regarding the geosynthetic material should be submitted, as needed to provide a comprehensive description of the component and the specification required for proper performance.

2.7.2 Design Methodology

Each ERS submittal should describe the design methodology that is used to model earth pressures, evaluate system performance (e.g. deflection and design life), and provide calculations for a typical structure. In many cases the methodology may be consistent with currently accepted standards. However, in other cases the methodology may be largely consistent with an accepted standard, but deviate in one or more important respects, or the methodology may depart completely from current practice.

If the design methodology is consistent with an accepted standard, then the description of the methodology can be brief, acknowledging the standards that are applicable. However, if the methodology departs from current practice then additional details of the governing design theories and their application are likely be required.

To illustrate, consider an example of a potentially minor deviation from AASHTO standards where the Applicant posits that its steel reinforcement behaves like an extensible rather than an inextensible material. Accordingly, for the Simplified Method the coefficient of lateral stress ratio (K/K_a) should be 1.0 (Berg et al., 2009). If such an assertion can be justified with appropriate data, it would represent the type of innovation that the IDEA program is intended to foster. This issue is discussed further in Section 2.7.

Each ERS submittal is required to include examples that illustrate how traffic surcharge loads, traffic barrier impact loads and crest slopes (sloping crest configurations) are addressed where applicable.

2.7.3 Construction

The procedures that should be used to construct the ERS should be thoroughly described such that they are clear to both installers and inspectors. The procedures should be provided with the submittal in a stand-alone document. If certain aspects of the construction procedure deviate

from conventional practices, then such a potential innovation will likely require in-depth explanation.

2.7.4 *Quality Control Measures*

A description of the quality control measures that apply to the structure design, component fabrication and ERS construction is required.

2.7.5 *ERS Performance History*

The relevant performance case histories of the ERS should be provided using the form provided at Appendix B. The form includes questions that help to illustrate potential limitations of the system's application and equally important, how the system has overcome the limitations of other systems.

2.8 *Submittal Checklists*

As previously mentioned, this protocol includes submittal checklists for several ERSs. They explain the information the Applicant should provide and include a detailed format for submittal organization. The checklists also include "commentaries" that describe information required for each item certain.

This protocol provides a checklist for the following MSE and gravity systems:

- Concrete modular block unit paired with extensible reinforcement.
- Concrete modular block unit paired with inextensible reinforcement.
- Precast concrete panel paired with extensible reinforcement.
- Precast concrete panel paired with inextensible reinforcement.
- Steel facing paired with extensible reinforcement.
- Steel facing paired with inextensible reinforcement.
- Precast concrete modular gravity system.
- Reinforced Soil Slope System with Extensible Reinforcement

For the instances where a checklist asks if a feature of the ERS conforms to AASHTO guidelines, actual confirmation of claimed conformance is necessary. In the case of the example of a deviation from AASHTO design guidelines in Section 2.7.2, the calculations for the design examples are to be provided to verify conformance. If the checklists included in this protocol are not appropriate for a new or innovative system evaluation, or if the system is different from those listed above, a custom checklist is developed to provide a systematic way to prepare an application that is sufficiently developed for the Review Team to consider.

3.0 GUIDANCE FOR USE OF TECHNICAL EVALUATIONS BY TRANSPORTATION AGENCIES

HITEC's *Guidelines for Evaluating Earth Retaining Systems* (HITEC, 1998) state that the HITEC report of evaluation does not approve, recommend, or endorse earth retention systems, but rather provides findings that can inform the product selection decisions made by transportation agencies. Despite this provision, the reports have been mistakenly interpreted to be blanket approvals or rejections of specific earth retention systems. The same policies hold true for the IDEA Program as well. Therefore, these guidelines are provided to assist transportation agencies to make effective use of Final Reports of Technical Evaluations. Each transportation agency should establish a means for considering IDEA program reports and approving use of any particular ERS on projects within its jurisdiction. These measures are necessary because highway construction conditions and policies and procedures for ERS approvals vary considerably between individual state DOTs and transportation agencies.

As with the HITEC program, the evaluation of ERSs and component innovations under the IDEA program consists of a technical review of the system and/or components. The report presents a summary of the technical review in the final report. The final report helps state or local agencies to evaluate the ERS more efficiently and advance the dissemination of ERS technology to construction projects. State or local agencies should update existing ERSs catalog descriptions such that their project can benefit from the innovation. The state or local transportation agencies are still responsible for the overall approval to employ a particular system. The extent to which an agency chooses to approve a specific ERS is completely left to the agency. It is also important to note that no particular ERS is suitable for all conditions because as site-specific factors can influence ERS selection, as described below.

3.1 Consideration of the Elements of an ERS

The elements of an ERS (i.e. components, design, construction and quality control) are specific to each system and must be considered in the determination of whether an ERS is suitable for the performance conditions for each project. No ERS is superior to all others under all performance conditions, despite what some manufacturers claim. For example, two criteria that indicate the use of one type of ERS over another are deformation limitations and corrosion resistance.

Deformation Limitations

Polymeric geosynthetic reinforcements exhibit lower tensile strength moduli than steel reinforcements. Consequently, an MSE ERS constructed with steel reinforcement will displace less than an MSE system constructed with geosynthetic reinforcement to support a given load if all other conditions are equivalent. For most wall applications, the difference in the displacements of two such walls is not an important consideration. However, if the ERS supports a structure that is especially sensitive to movement, then the use of an ERS that is based on steel reinforcement may be indicated.

Corrosion Limitations

Steel reinforcements are subject to corrosion under environmental conditions that are benign for geosynthetic reinforcements. The limits recommended by FHWA for three of these conditions are shown in Table 3-1.

Table 3-1: Recommended limits of electrochemical properties for reinforced fill with steel reinforcements (Berg et al., 2009).

3.2 Property	3.3 Limit
Resistivity	>3000 ohm-cm
Chlorides	<100 ppm
Sulfates	<200 ppm

The limits shown in Table 3-1 may proscribe the use of steel reinforcement in walls that are subject to water runoff from coal mines or inundation by seawater. These conditions may be better accommodated by the use of geosynthetic reinforcement.

In addition to the two examples presented above, there are numerous other examples that demonstrate that a variety of site-specific considerations can affect the performance of an ERS. These conditions may include other environmental conditions (extreme temperature impacts to specific components and drainage conditions) as well as constructability considerations. These examples illustrate two important points about earth retention systems and how they are employed:

- Not all systems are appropriate for all performance conditions.
- The design of an ERS and selection of wall elements must be based on the site conditions, performance requirements, and the properties of the system's elements.

3.4 Guidelines for Approval of an ERS

As previously stated, the IDEA Review Report evaluates the technical aspects of a given ERS or component. Local or State transportation agencies still need to approve, disapprove or provide limited acceptance of the ERSs or components based on their own policies and procedures.

The elements of an ERS are specific to each system and must be considered to determine if an ERS is suitable for the performance conditions for a given project. During this process, the Report of Technical Evaluation is the best tool an Agency has to identify the capabilities and limitations of an ERS. But before the report can be used, the Agency must first determine the relevant performance conditions.

An Agency's submittal procedures for each earth retention project should account for each of the four ERS elements:

- Components.
- Design.
- Construction Procedures.
- Quality Control Measures.
- System Performance History

During the Agency's review, it should check that the information for each element is consistent with the current report of technical evaluation. Again, if a change has been made to an element of the ERS, then the Agency should review the reported change to assess its significance.

3.4.1 Performance Conditions

The performance conditions that determine the suitability of an ERS for a given project or types of projects generally fall into five categories: ERS geometry, loads, environmental factors, geotechnical factors, and constructability factors. Each is briefly discussed below. Additionally the performance of an ERS may also be affected by the degree of cut or fill at a particular location. A more extensive discussion of performance conditions can be found in *Design and Construction of Mechanically Stabilized Earth Walls—Volumes I* (Berg et al., 2009).

3.4.1.1 ERS Geometry

A description of an ERS's geometry includes height, layout, batter, tiers, toe slopes, crest slopes, three-dimensional considerations (outside corners or curves), and top-of-structure details. The first three are the most likely to limit the number of suitable systems. For example, tall ERSs demand a greater structural capacity from an ERS than a comparatively short structure does. If the batter of an ERS is relatively large, then the design engineer must determine if the horizontal distance required between the structure toe and the structure crest will leave enough room for guard rails, fence and curbs behind the structure crest.

If the layout of an ERS includes outside corners or curves, then potential three-dimensional effects should be considered. Research and field inspections shows that outside corner and curve configurations require special attention to internal and external stability analyses, design detailing, construction procedures, backfill specifications, and soil compaction to obtain satisfactory structure performance.

3.4.1.2 ERS Loads

The design of an ERS requires consideration of loads created by structure height, traffic, crest slopes, adjacent structures, ERS stiffness, and excess soil pore water pressures. Obviously some

loads are transient and others are relatively permanent. All cause displacement of the structure and the magnitude of the displacements depend in part on the properties of the ERS elements.

3.4.1.3 Environmental Factors

Environmental factors can severely restrict the suitability of different ERSs. The potential effect of the electro-chemical properties of fill soil on steel reinforcement was previously discussed, but such properties must also be considered for geosynthetics. Freeze-thaw durability can be a significant concern for concrete, and spray from deicing salt solutions can have a corrosive effect on both dry-cast and wet-cast concrete facing units, as well as steel facing and reinforcement components. Typical and potential site and ERS drainage conditions must be considered to ensure that ERS performance will remain acceptable.

3.4.1.4 Geotechnical Factors

There are many geotechnical factors that influence the design of an ERS, but only a relative few have important implications for the type of ERS that should be selected. Of these few factors, foundation settlement and global stability are perhaps the most important. This is because flexible ERSs accommodate differential settlement more effectively than rigid ERSs. MSE structures are generally regarded as being flexible, but even among the different MSE systems there is a wide range of tolerances for differential settlement. The tolerances are mostly a function of the facing system. For example, consider that precast full-height panel facing systems are limited to a differential settlement ratio of about 1:500 and welded-wire facing systems to about 1:50 (NHI, 2009).

3.4.1.5 Constructability Factors

Construction details and procedures are key considerations for an ERS. Perhaps the most common constructability factor for MSE structures is the availability of right-of-way behind the ERS face to install reinforcement. The distance between the structure face and the right-of-way must be sufficient for the full reinforcement design length. If construction of the reinforced soil zone requires excavation into an existing hillside, the stability of the temporary slope must be assured. If the distance available for reinforcement is inadequate, or if the stability of a temporary excavation is inadequate, then another type of ERS should be considered (e.g. semi-gravity, modular gravity, and top-down construction).

Another condition that requires consideration of ERS constructability is water. MSE structures should typically be constructed “in the dry”. If an ERS is required at the edge of an existing body of water, then the use of cofferdams and dewatering measures may be necessary. Given such conditions, a non-gravity cantilever system may be more appropriate (e.g. sheet piles).

A site condition that is often unanticipated and that can induce complete failure during ERS construction is surface water runoff. If surface water drains towards an ERS, it is imperative that

measures be taken to divert the runoff away from the structure during its construction. Otherwise, the water can erode soil from behind the ERS face and undermine the base. One study of the causes of failure of 45 MSE ERSs found that uncontrolled surface water runoff was a significant factor in seven of the failures (Valentine, 2013).

3.4.1.6 Other Factors

In addition to the performance conditions described above, an Agency may have considerations that are specific to its geographical region or result from legislation. Such considerations may include seismic loads, scour, soil liquefaction and building setbacks. A discussion of these considerations is beyond the scope of this evaluation protocol.

3.5 Specifications for ERS evaluations

Project specifications should address the appropriate use of ERSs that have had an IDEA Technical Evaluation such that the State or local agency recognizes that the Technical Evaluation is limited to the technical performance of the system and its construction and QA/QC methodology. Some State or local agencies may have their own technical evaluation process for ERSs that would be required in addition to or in lieu of an IDEA Program Technical Evaluation. On the other hand, there may be some agencies that do not have the technical resources to perform its own evaluation and thus may rely on the IDEA Technical Evaluation. In each case, it is important to recognize that the FHWA IDEA Technical Evaluation is not an Approval for a particular ERS. Rather, it is an assessment of the ERS components, design methodology, construction, quality control and performance history.

4.0 GUIDANCE FOR ADMINISTRATION AND MAINTENANCE OF FINAL REPORTS OF TECHNICAL EVALUATIONS

To make efficient use of the reports of technical evaluations, the IDEA Program administrator should design a process by which it can track and disseminate reports it has received and ensure that the reports remain current. Toward these goals, guidance is provided for report administration and maintenance.

4.1 Administration

The IDEA Program Coordinator's administration of technical evaluation reports should provide for the following:

- Coordination.
- Distribution.
- Archiving.

4.1.1 Report Coordination

A process should be developed to coordinate receipt of reports of technical evaluation from the Evaluation Review Panel and Review Team and to keep track of the reports that have been issued. The department should also initiate the Agency's requests for System Reviews when they are needed and track the status of responses to those requests. A specific numbering system can be developed to display the type of ERS, year it was evaluated, and version number. For example, referring to Figure 2-1, a technical evaluation report number for a soil nail wall system could be SN-15-001. This number indicates that it is a soil nail wall evaluated in 2015 and that this is the first version of that technical evaluation.

4.1.2 Report Distribution

The process should also provide for the distribution of reports of technical evaluations to the Agency's departments that will use the reports. These departments may include:

- Earth retention structure design.
- Materials testing.
- Construction inspection.
- Geotechnical engineering.
- Structural Engineering.

4.1.3 Report Archiving

Reports of evaluation should be archived in a manner that not only allows them to be readily located and disseminated, but makes it easy to determine if they are current. A key element to

ensure that the most current reports are distributed is to develop a version control identification system that will be maintained as reports are updated or modified.

4.2 Report Maintenance

Reports of technical evaluation are useful to a state or local transportation agency only to the degree that they contain the most current evaluation information. As discussed in Section 2.3.2, an Update Technical Evaluation will need to be performed to ensure that the information they contain remains current. The decision to perform an update evaluation is based on the results of a System Review. One of the four triggers that can initiate a System Review is a request by a transportation agency.

If an Applicant has changed an element of its ERS, it should request a System Review. However, local vendors (e.g. contractors or licensed system distributors) of an ERS may propose the system for use on an Agency's project, unaware that an ERS element has been modified. Therefore, the Agency should include the current Technical Evaluation Report and a Statement of Technical Evaluation Report Currency in its list of submittal requirements for each earth retention project, as described below.

4.2.1 Statement of Technical Evaluation Report Currency

The submittal from a vendor of an ERS for each project should include a statement by the vendor that it has asked the Applicant if the Applicant has changed an element of the ERS since the last report of technical evaluation (i.e. Report of Initial Technical Evaluation or Report of Update Technical Evaluation), as well as the Applicant's response. If a change has been made to an element of the ERS, then the Agency should review the reported change to assess its significance.

5.0 REFERENCES

American Association of State Highway and Transportation Officials. AASHTO LRFD Bridge Design Specifications, 10th ed., Washington, DC, 2024 (with 2025 Errata).

Berg, R., Christopher, B. and Samtami, N. (2009). *Design and Construction of Mechanically Stabilized Earth Walls—Volumes I and II*, Publication No. FHWA-NHI-10-024 / 025, Washington, D.C.

Elias, V., Fishman, K., Christopher, B. and Berg, R. (2009). *Corrosion / Degradation of Soil Reinforcements for Mechanically Stabilized Earth Walls and Reinforced Slopes*, Publication No. FHWA-NHI-09-087, Washington, D.C. Highway Innovative Technology Evaluation Center (1998). *Guideline for Evaluating Earth Retaining Systems*, Civil Engineering Research Foundation, American Society of Civil Engineers, Reston, VA.

Highway Innovative Technology Evaluation Center (HITEC) (1998). *Guidelines for Evaluation Earth Retaining Systems*, Civil Engineering Research Foundation (CERF), Reston, VA.

Lazarte, C., Robinson, H., Gomez, J., Baxter, J., Cadden, A. and Berg, R. (2015). *Geotechnical Engineering Circular No. 7 Soil Nail Walls—Reference Manual*, Publication No. FHWA-NHI-14-007.

National Highway Institute (2009). Design and Construction of MSEW and RSS, Section 004, Site and Project Evaluations, NHI Course No. 132042, Washington, D.C.

Sabatini, P., Pass, D., and Bacchus, R. (1999). *Geotechnical Engineering Circular No. 4*, Publication No. FHWA-IF-99-015, Washington, D.C.

Tanyu, B., Sabatini, P. and Berg, R. (2001). *Earth Retention Structures*, Publication No. FHWA-NHI-07-071, Federal Highway Administration, Washington, D.C.

Valentine, R. J. (2013). *An Assessment of the Factors that Contribute to the Poor Performance of Geosynthetic-Reinforced Earth Retaining Walls*, Proceedings of the International Symposium on Design and Practice of Geosynthetic-Reinforced Soil Structures, Bologna, Italy, editors Ling, Gottardi, Cazzuffi, Han, and Tatsuoka, DEStec Publications, pp. 318-327.

APPENDIX A

Highway Innovation Developments, Enhancements and Advancements (IDEA)

Technical Evaluation Process

Definitions:

1. Applicant – A manufacturer or holder of a patented earth retaining system that wishes to undertake a technical evaluation under the IDEA program.
2. Administrator – IDEA Administrator coordinates system review activities and the exchange of information and requests with Applicant and Reviewers.
3. Review Consultant (RC) – Private sector subject matter expert consultant responsible for the system evaluation, draft and finalize review phase reports (see Section 2.5.2).
4. Review Team (RT) – Provide consultation with the RC when required and review the findings and recommendations of the Review Consultant (see Section 2.5.2).
5. IDEA Evaluation Committee: GI board level committee responsible for the overall IDEA program.

		Evaluation Team Action		
Review Phase ⁽¹⁾	Applicant Action	Administrator Action	Review Consultant	Review Team
Milestone 1: Pre-Submittal Review Phase Time estimate – 1 week	<ul style="list-style-type: none"> • Apply for Technical Evaluation • Pay application fee 	<ul style="list-style-type: none"> • assign review consultant and review team • Acknowledge application and send onto Review Consultant • Forward RC approval to applicant 	<ul style="list-style-type: none"> • Review request and approve for technical evaluation – <i>two weeks to review request and respond to applicant.</i> 	No action
Milestone 2: Submittal Check and Applicant Response Time estimate – 2 weeks	<ul style="list-style-type: none"> • Prepare submittal • Pay fee for next action 	<ul style="list-style-type: none"> • Acknowledge submittal and send onto Review Consultant • Coordinate communications between applicant and RC 	<ul style="list-style-type: none"> • Review submittal and checklists for completeness • Issue Initial Report of Submittal Checklist – <i>two weeks to draft Initial Report</i> 	No action

		Evaluation Team Action		
Review Phase ⁽¹⁾	Applicant Action	Administrator Action	Review Consultant	Review Team
	<ul style="list-style-type: none"> • Response to RC comments • Finalize comments or withdraw application – <i>target two weeks to respond to Initial Report</i> • Suspend application after 4 weeks of no response 		<ul style="list-style-type: none"> • Review Applicant response to Initial Report – <i>one week to review response</i> • Report Initial Report complete decision 	
<p>Milestone 3: Submittal Review Time estimate – 8 weeks</p>	<ul style="list-style-type: none"> • Pay fee for next action 	<ul style="list-style-type: none"> • Provide applicant with updates when warranted • Coordinate activities of RC and RT to resolve comments and finalize Draft Preliminary Report of Technical Evaluation 	<ul style="list-style-type: none"> • Evaluate the technical content of the submittal • Draft Preliminary Report of Technical Evaluation – <i>four weeks to review and draft report</i> • Respond to RT comments – <i>one week to respond to RT comments and/or revise</i> 	<ul style="list-style-type: none"> • Review Preliminary Report of Technical Evaluation – <i>two weeks to review report</i>

		Evaluation Team Action		
Review Phase ⁽¹⁾	Applicant Action	Administrator Action	Review Consultant	Review Team
	<ul style="list-style-type: none"> Respond to Preliminary Report of Technical Evaluation - <i>target two weeks to respond to Preliminary Report</i> 	<ul style="list-style-type: none"> Deliver Draft Preliminary Report of Technical Evaluation to applicant Coordinate report comments with applicant and RC 	<ul style="list-style-type: none"> Issue to Administrator Preliminary report to Applicant Respond to Applicant comments; if needed – <i>one week to respond to applicant</i> 	
Milestone 4: Final Report Phase Time estimate – one week	<ul style="list-style-type: none"> Pay fee Approve publication of Technical Evaluation at GI Website 	<ul style="list-style-type: none"> Deliver Final Technical Evaluation 	<ul style="list-style-type: none"> Complete Final Technical Evaluation - <i>one week to review and draft report</i> 	No action

Notes: 1) Review phases defined within “*Highway Innovations, Developments, Enhancements and Advancements (IDEA)—Protocol for Technical Evaluation of Earth Retention Systems*”

Commentary

- 1) Pre-Submittal Review Phase – The first phase of the technical evaluation process in the IDEA program.
 - Applicant provides its request for a Technical Evaluation to Administrator; Brief description of the Applicant’s ERS and designation of the checklist the Applicant believes to be appropriate.
 - Administrator forwards the application to the Review Consultant. The Review Consultant considers the request and informs Administrator the a review is authorized
 - Review Consultant determines whether a custom checklist should be developed. If a custom checklist is needed, then the time and cost to prepare it must be determined and sent onto the Administrator.
- 2) Submittal Check Phase – A completeness review of the original submittal for technical evaluation.
 - Applicant prepares its submittal (Applicant advised that if ERS contains an innovation or change to a previously evaluated system, then it is the Applicant’s responsibility to thoroughly document the innovation in terms of complete descriptions, test data, and design methodology)
 - Upon approval of the report by the Review Team, a final version is sent to the Applicant.
 - Applicant may elect to withdraw from the review process.
- 3) Submittal Review Phase – A completeness review of the applicant submittal for technical evaluation.
 - Evaluate the technical content of the submittal for conformance to the applicable references
 - RC Preliminary Report of Technical Evaluation presents findings factually and succinctly.
 - Draft version of report then provided to the RT.
 - Approval of report by Review Team
 - Final version is sent to the Applicant.
 - Applicant may elect to withdraw from the review process.
- 4) Final Submittal Review Phase – The last phase of the technical evaluation process in the IDEA program.
 - Applicant’s response is used to complete the review.
 - Publish

APPENDIX B

Highway Innovation Developments, Enhancements and Advancements (IDEA)

Checklists for eight ERS Types. See the IDEA website for the latest checklists:

1. Concrete Modular Block Unit Paired with Extensible Reinforcement
2. Concrete Modular Block Unit Paired with Inextensible Reinforcement
3. Precast Concrete Panel Paired with Extensible Reinforcement
4. Precast Concrete Panel Paired with Inextensible Reinforcement
5. Steel Facing Paired with Extensible Reinforcement
6. Steel Facing Paired with Inextensible Reinforcement
7. Precast Concrete Modular Gravity Wall System
8. Reinforced Soil Slope System with Extensible Reinforcement

<https://www.geoinstitute.org/special-projects/idea>

APPENDIX C

LEGACY FEDERAL HIGHWAY ADMINISTRATION PUBLICATION COVER AND INFORMATION



Notice

This document is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The U.S. Government assumes no liability for the use of the information contained in this document.

The U.S. Government does not endorse products or manufacturers. Trademarks or manufacturers' names appear in this report only because they are considered essential to the objective of the document.

Quality Assurance Statement

The Federal Highway Administration (FHWA) provides high-quality information to serve Government, industry, and the public in a manner that promotes public understanding. Standards and policies are used to ensure and maximize the quality, objectivity, utility, and integrity of its information. FHWA periodically reviews quality issues and adjusts its programs and processes to ensure continuous quality improvement

1. Report No. FHWA-16-006	2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Highway Innovations, Developments, Enhancements and Advancements (IDEA)—Protocol for Technical Evaluation of Earth Retention Systems		5. Report Date September 2016		
		6. Performing Organization Code:		
7. Author(s) Kenneth A. Johnson, P.E., Ph.D., Richard J. Valentine*, P.E.		8. Performing Organization Report No.		
9. Performing Organization Name and Address WSP Parsons Brinckerhoff 1015 Half Street, SE Washington, DC 20003 *Valentine Engineering Associates, Inc., Walla Walla, WA 99362		10. Work Unit No.		
		11. Contract or Grant No. DTFH6114D00047-5009		
12. Sponsoring Agency Name and Address Federal Highway Administration HIBT-20 Office of Bridge Technology 1200 New Jersey Avenue, SE Washington, DC 20005		13. Type of Report and Period Covered		
		14. Sponsoring Agency Code		
15. Supplementary Notes FHWA COR – Silas Nichols, P.E. PB Technical Reviewer - Brian Zelenko, P.E. FHWA Alt. COR – Khalid Mohamed, P.E. PB Technical Reviewer – Raymond Castelli, P.E. FHWA Technical Reviewer – Daniel Alzamora, P.E. FHWA Technical Reviewer – Jennifer Nicks, PhD, P.E.				
16. Abstract The Highway Innovative Technology Evaluation Center (HITEC) program was initiated over 20 years ago to facilitate the introduction of new and innovative technologies into highway construction. HITEC evaluations have been used by state agencies to improve their transportation infrastructures and by manufacturers to improve their products. Earth retention is now a mature technology. Over the last two decades techniques to retain earth have evolved, particularly those that are based on mechanically stabilized earth (MSE) concepts. The viability of MSE structures in state transportation applications is no longer in question and other ERS methods have been developed. Rather, the goal of the Highway Innovations, Developments, Enhancements and Advancements (IDEA) program is to foster further innovation with proven ERS technology, encourage the development of new technologies, and improve the methods by which the technologies are delivered to projects on the ground. The IDEA program is intended to provide a consistent framework to propose changes to standard practice that owners may take advantage of by expanding ERS innovations in their projects. Towards this goal, this IDEA Protocol has been developed to provide guidance for three tasks: 1) the technical evaluation of earth retaining systems; 2) the use of reports of evaluations by transportation agencies; and 3) archiving and maintenance of reports of evaluations.				
17. Key Words Earth Retaining Systems (ERS), Mechanically Stabilized Earth (MSE) structures, Innovative Technologies, HITEC, IDEA Program		18. Distribution Statement No restrictions		
19. Security Classif. (of this report) UNCLASSIFIED	20. Security Classif. (of this page) UNCLASSIFIED	21. No. of Pages: 83	22. Price	
Form DOT F 1700.7 (8-72) Reproduction of completed page authorized				